

Spatial-temporal Visualization in R

Bing Zhang

Email: zhangbing4502431@outlook.com

Homepage: <http://spatial-r.github.io/>

Zhejiang Provincial Center for Disease Control and Prevention

Outlines

Introduction

Introduction to R software

Introduction to Data Visualization

Introduction to Spatial-temporal Data

Time-series Visualization

Spatial Visualization

Spatial-temporal Visualization

Spatial-temporal

Bing Zhang

2

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal

Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Introduction to R software

R is an integrated suite of software facilities for data manipulation, calculation and graphical display, which can be regarded as an implementation of the S language.

- ▶ an effective data handling and storage facility.
- ▶ a suite of operators for calculations on arrays, in particular matrices.
- ▶ a large, coherent, integrated collection of intermediate tools for data analysis
- ▶ graphical facilities for data analysis and display either directly at the computer or on hardcopy.
- ▶ a well developed, simple and effective programming language

Spatial-temporal

Bing Zhang

Introduction

3

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal

Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

21

Introduction to Data Visualization

Spatial-temporal

Bing Zhang

Introduction

R software

4 Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal

Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

- ▶ **Process:** Information that has been abstracted in some **schematic form**, including attributes or variables for the units of information.
- ▶ **Aim:** Revealing unexpected patterns and trends in the otherwise-hidden information around us.
- ▶ **Keypoint:** Information first, beauty second.
- ▶ **Note:** Don't visualize for the visualization. Make sure you know which information you want to show.

Introduction to Spatial-temporal Data

The spatial-temporal data is an object with the spatial and temporal attribution. Data format:

- ▶ In long tables:

data.frame objects with longitude, latitude and time as three of the columns, or an identifier for a location or region and time as columns.

- ▶ In time-wide tables:

When a single attribute is considered, each observational unit forms a record and each column an observation time.

- ▶ In space-wide tables:

Time series as different columns, each column representing one location.

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

5 Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal

Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Outlines

Introduction

Time-series Visualization

Static visualization for time-series

Interactive visualization for time-series

Spatial Visualization

Spatial-temporal Visualization

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

6 Time-series
Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal
Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Static time-series: basic plot

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

7

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

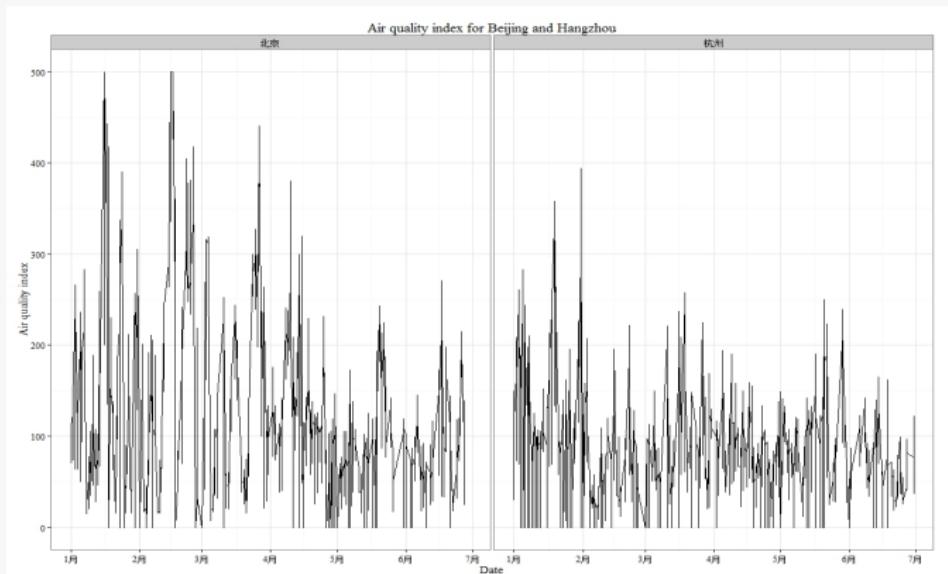
Spatial-temporal

Visualization

Static Spatial-temporal

Interactive Spatial-temporal

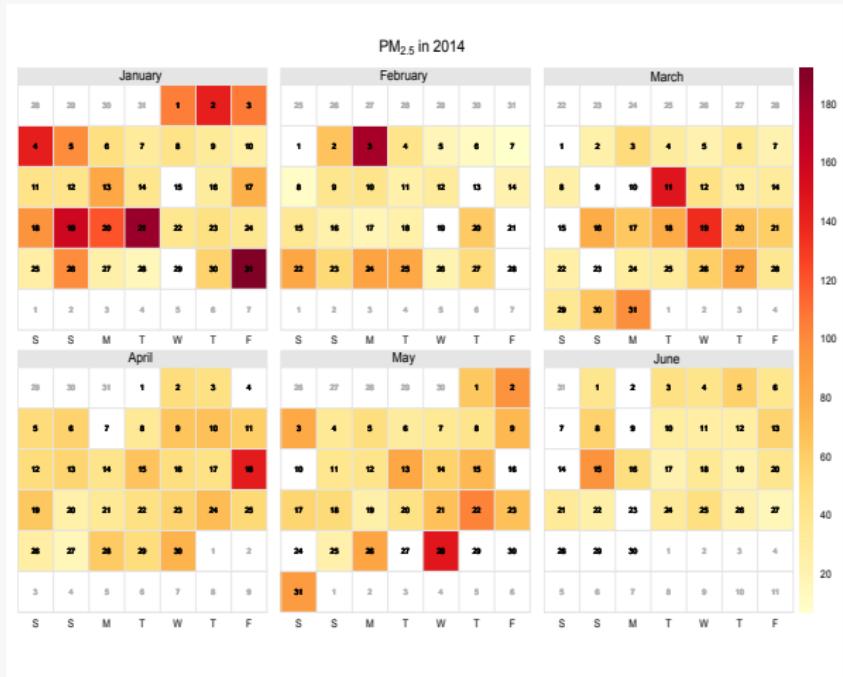
Zhejiang Provincial Center
for Disease Control and
Prevention



Basic plot for the air quality index in Beijing and Hangzhou city.

Package `ggplot2`: {ggplot function}. Other ways are [here](#)

Static time-series: Calendar chart



Calendar chart for the PM_{2.5} concentration in Shanghai.
Package [openair](#): {calendarPlot function}.

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

8

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal

Visualization

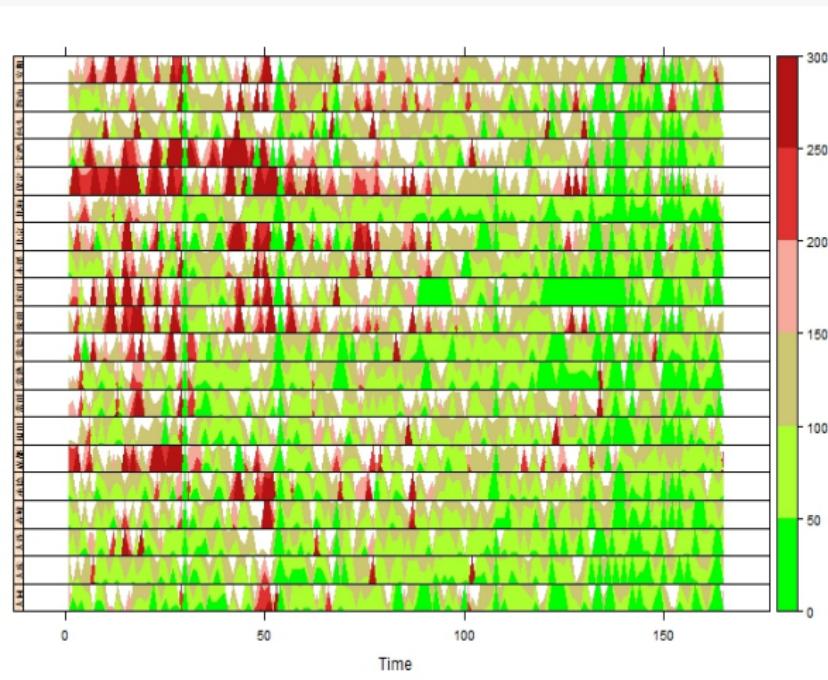
Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

21

Static time-series: Horizon plot



Horizon plot for the air quality index in several cities, 2014.

Package [latticeExtra](#): {horizonplot function}.

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series
Visualization

9 Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

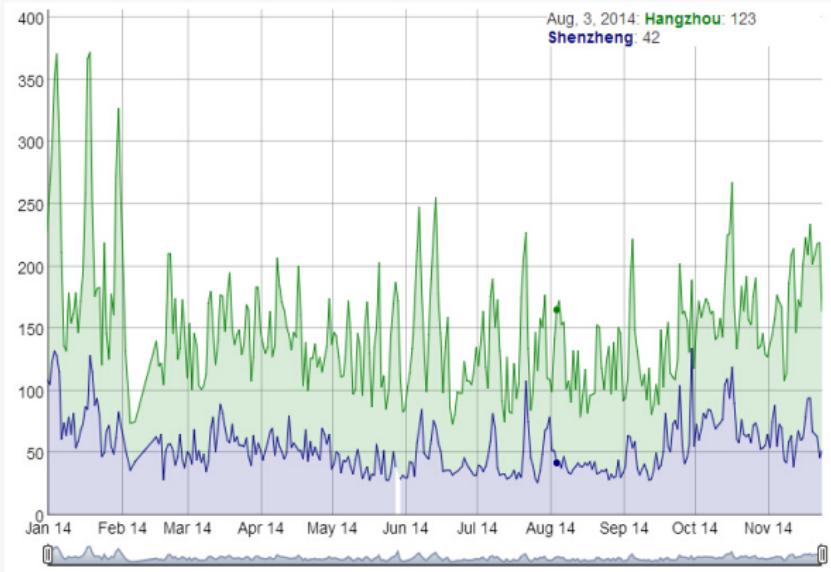
Spatial-temporal
Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Interactive time : Dygraphs JavaScript



Dygraphs JavaScript for the air quality index in Hangzhou and Shenzhen.

Package **dygraph** : {dygraph function}.

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal

Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Outlines

Introduction

Time-series Visualization

Spatial Visualization

Static visualization for spatial

Interactive visualization for spatial

Spatial-temporal Visualization

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series
Visualization

Static Time

Interactive Time

11 Spatial Visualization

Static Spatial

Interactive Spatial

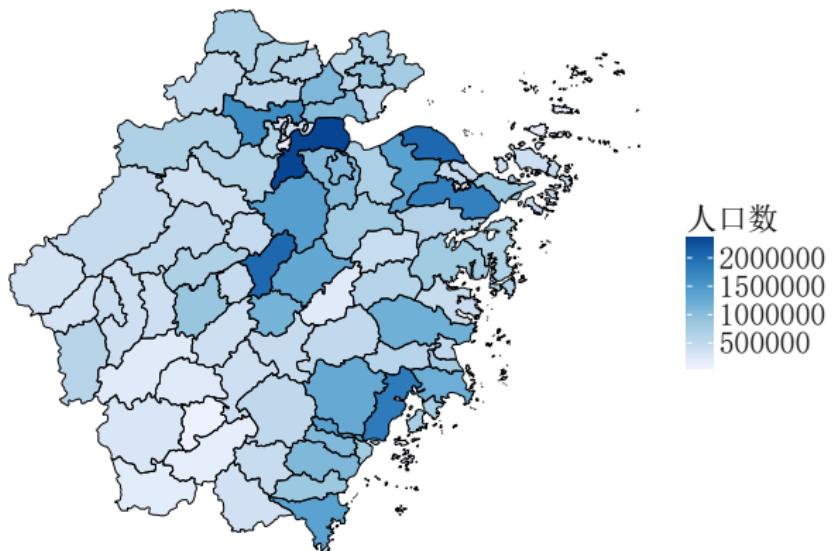
Spatial-temporal
Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Static Spatial-region



Total population of each district in Zhejiang province. Package
ggplot2: {geom_polygon function}.

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

12 Static Spatial

Interactive Spatial

Spatial-temporal

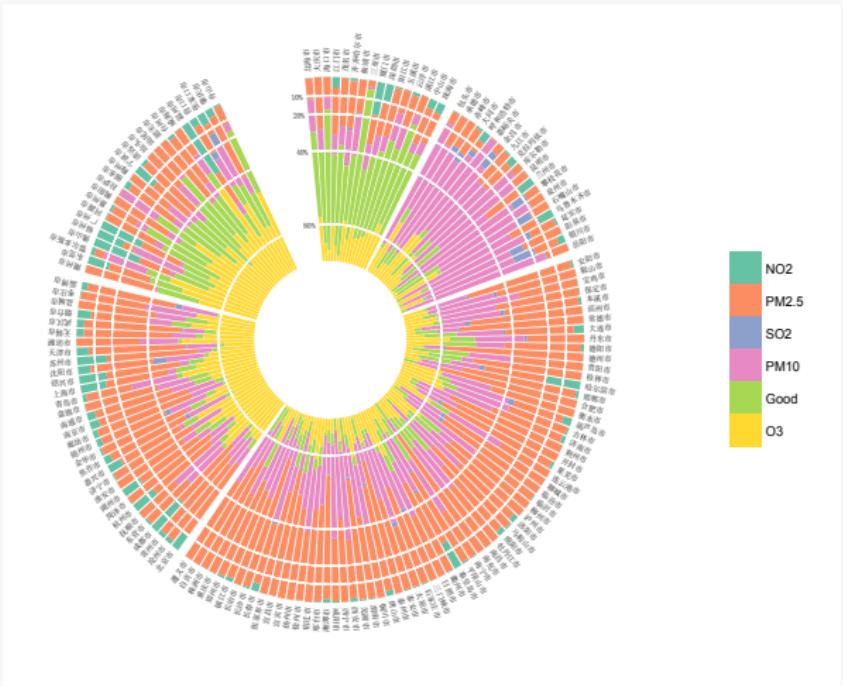
Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Static Spatial-region



Air pollutants in 113 cities, China. [polarHistogram](#) function.

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

13 Static Spatial

Interactive Spatial

Spatial-temporal

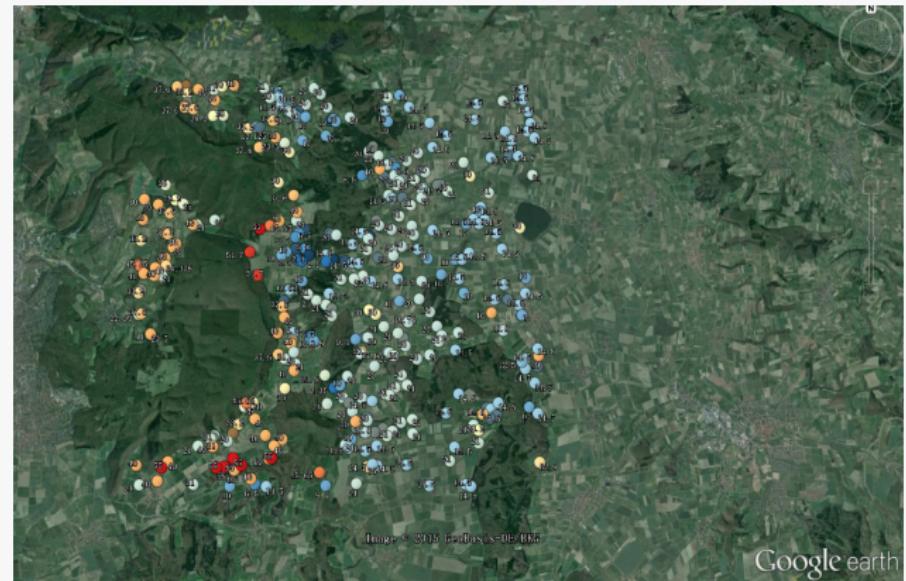
Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Interactive Spatial-point



Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

14 Interactive Spatial

Spatial-temporal

Visualization

Static Spatial-temporal

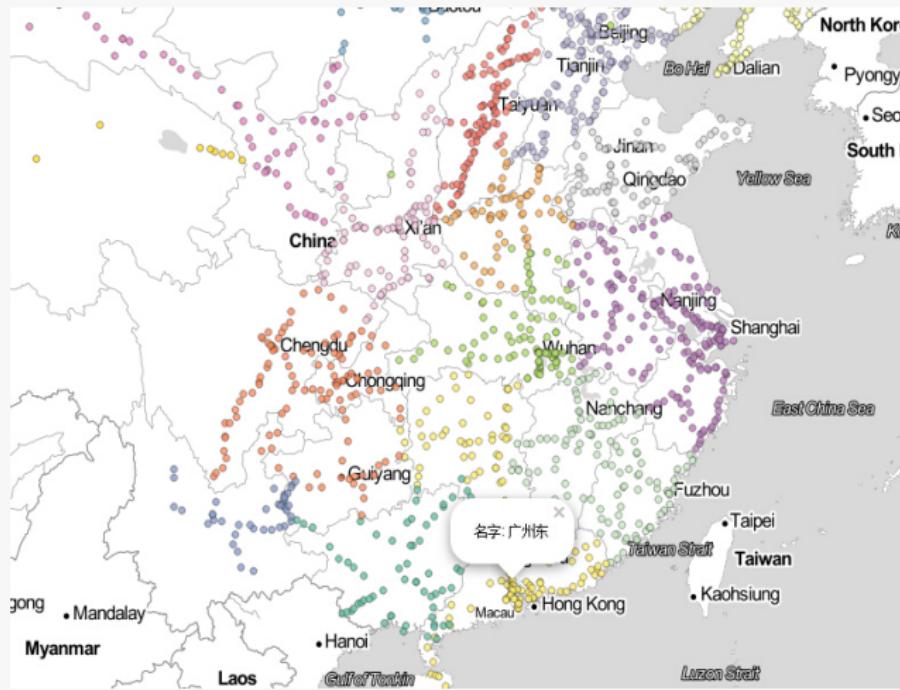
Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Sample of soil textures in Central Germany.

Package `plotKML` {kml function} creat the kml file and visualize in the google earth.

Interactive Spatial-point



Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal

Visualization

Static Spatial-temporal

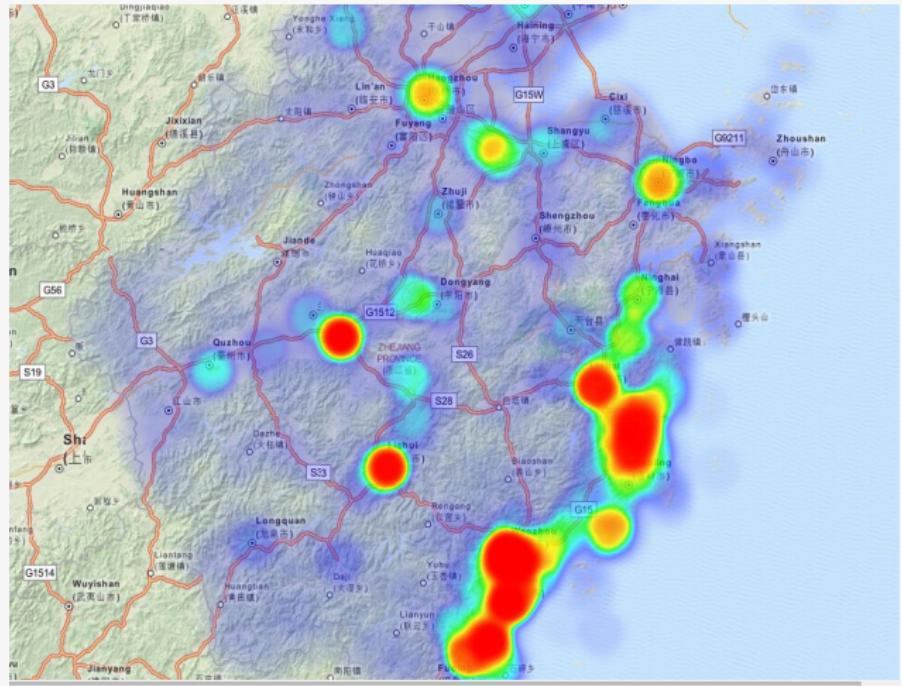
Interactive Spatial-temporal

15

Package [leaflet](#) for the train station in China.

Zhejiang Provincial Center
for Disease Control and
Prevention

Interactive Spatial -point



Hotspot Map created by the [leaflet-heat.js](#) for infectious disease.

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

16 Interactive Spatial

Spatial-temporal

Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Outlines

Introduction

Time-series Visualization

Spatial Visualization

Spatial-temporal Visualization

Static visualization for spatial-temporal

Interactive visualization for spatial-temporal

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series
Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

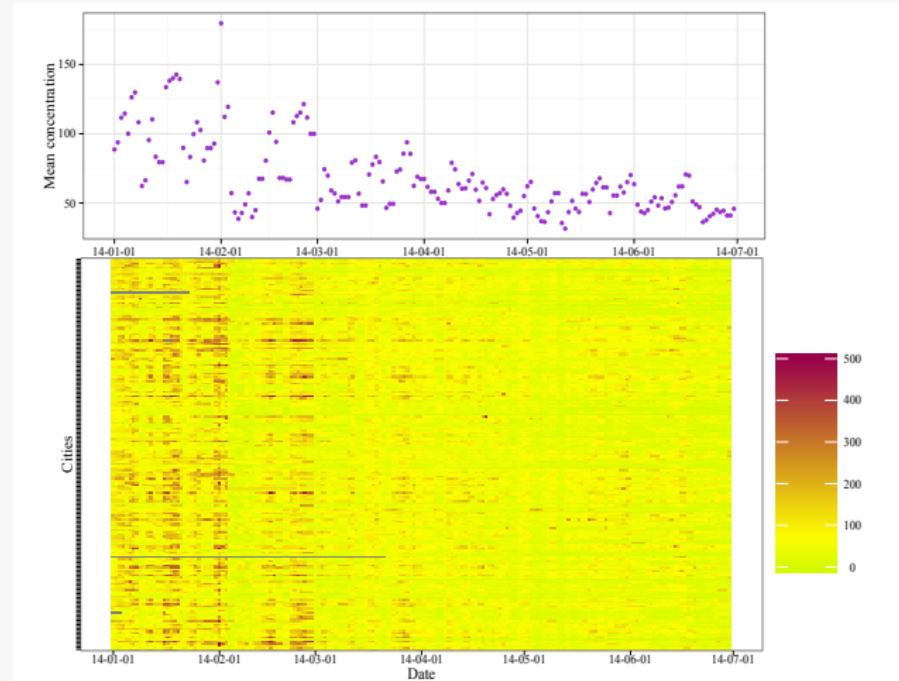
17 Spatial-temporal
Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Static Spatial-temporal-1



Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal

Visualization

18

Static Spatial-temporal

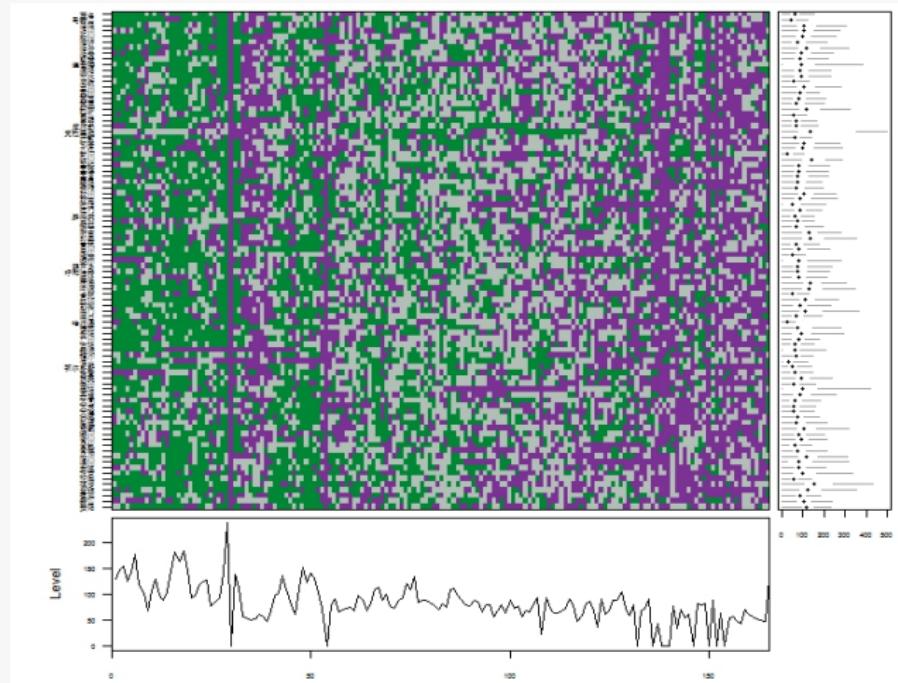
Interactive Spatial-temporal

Package **ggplot2**: {ggplot function}.

Zhejiang Provincial Center
for Disease Control and
Prevention

21

Static Spatial-temporal-2



Daily air quality index for 90 cities in China.

Package **mvsplot**: {mvtspplot function}.

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal

Visualization

19

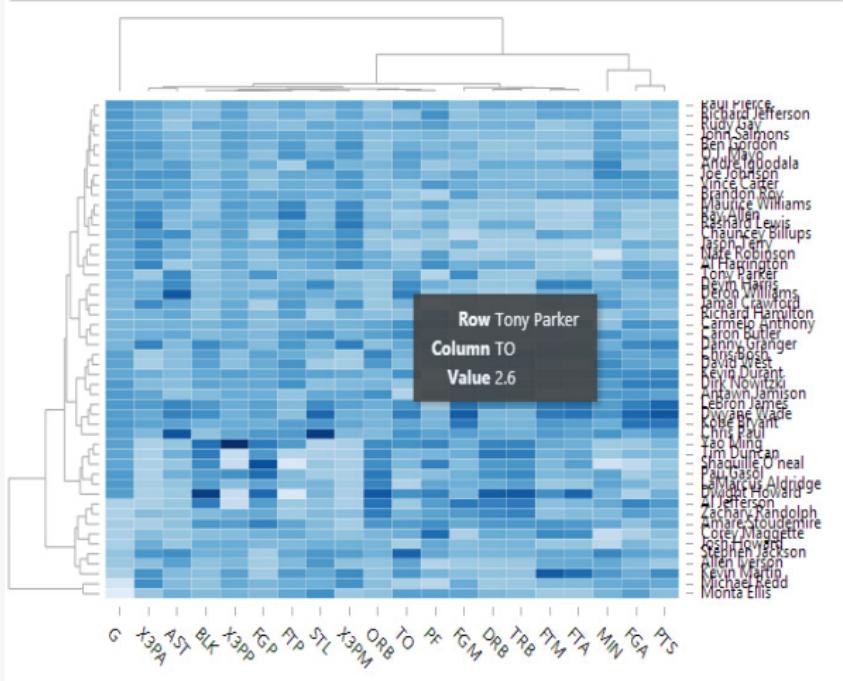
Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

21

Interactive Heatmap



Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal

Visualization

Static Spatial-temporal

Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

20

21

Animation for disease point

Spatial-temporal

Bing Zhang

Introduction

R software

Data Visualization

Spatial-temporal

Time-series

Visualization

Static Time

Interactive Time

Spatial Visualization

Static Spatial

Interactive Spatial

Spatial-temporal

Visualization

Static Spatial-temporal

21 Interactive Spatial-temporal

Zhejiang Provincial Center
for Disease Control and
Prevention

Package surveillance: animate function.

21